



Lift and Circulation Formulas

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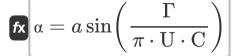




List of 16 Lift and Circulation Formulas

Lift and Circulation &

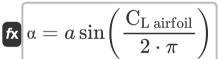
1) Angle of Attack for Circulation developed on Airfoil



Open Calculator 🗗

$$oxed{ex} \left[6.506912 ^{\circ} = a \sin igg(rac{62 \mathrm{m}^2/\mathrm{s}}{\pi \cdot 81 \mathrm{m/s} \cdot 2.15 \mathrm{m}} igg)
ight]$$

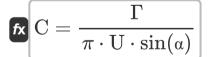
2) Angle of Attack for Lift Coefficient on Airfoil



Open Calculator 🗗

$$\texttt{ex} \ 6.506638° = a \sin \biggl(\frac{0.712}{2 \cdot \pi} \biggr)$$

3) Chord Length for Circulation developed on Airfoil



Open Calculator

$$ag{2.152276} ext{m} = rac{62 ext{m}^2/ ext{s}}{\pi \cdot 81 ext{m/s} \cdot ext{sin}(6.5\degree)}$$





4) Circulation developed on Airfoil

fx $\Gamma = \pi \cdot U \cdot C \cdot \sin(\alpha)$

Open Calculator

 $\mathbf{ex} \ 61.93442 \mathrm{m}^2/\mathrm{s} = \pi \cdot 81 \mathrm{m/s} \cdot 2.15 \mathrm{m} \cdot \sin(6.5^\circ)$

5) Circulation for Single Stagnation Point

fx $\Gamma_c = 4 \cdot \pi \cdot \mathrm{V}_{\infty} \cdot \mathrm{R}$

Open Calculator

ex $243.1593 \mathrm{m}^2/\mathrm{s} = 4 \cdot \pi \cdot 21.5 \mathrm{m/s} \cdot 0.9 \mathrm{m}$

 $\Gamma_{
m c} = -(\sin(heta)) \cdot 4 \cdot \pi \cdot {
m V}_{\infty} \cdot {
m R}$

6) Circulation in Location of Stagnation Points

ex $243.1593 \mathrm{m}^2/\mathrm{s} = -(\sin(270\degree)) \cdot 4 \cdot \pi \cdot 21.5 \mathrm{m/s} \cdot 0.9 \mathrm{m}$

Open Calculator

Open Calculator G

Open Calculator 6

7) Coefficient of Lift for Airfoil fx $\mathrm{C_{L~airfoil}} = 2 \cdot \pi \cdot \sin(lpha)$

 $\texttt{ex} \ 0.711277 = 2 \cdot \pi \cdot \sin(6.5°)$

8) Lift coefficient for lift force in body moving on fluid 🗹

 $\left[\mathrm{C_L} = rac{\mathrm{F'_L'}}{\mathrm{A_p \cdot 0.5 \cdot
ho \cdot (v^2)}}
ight]$

0.944451 = ---

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1100N

 $1.88 \text{m}^2 \cdot 0.5 \cdot 1.21 \text{kg/m}^3 \cdot \left(\left(32 \text{m/s}\right)^2\right)$



9) Lift Coefficient for Rotating Cylinder with Circulation

 $\mathbf{K} \left[\mathrm{C}^{'} = rac{\Gamma_{\mathrm{c}}}{\mathrm{R} \cdot \mathrm{V}_{\sim}}
ight]$

Open Calculator

 $ext{ex} 12.55814 = rac{243 ext{m}^2/ ext{s}}{0.9 ext{m} \cdot 21.5 ext{m/s}}$

10) Lift Coefficient for Rotating Cylinder with Tangential Speed

 $\left[\mathbf{C}^{'} = rac{2 \cdot \pi \cdot \mathrm{v_{t}}}{\mathrm{V_{\infty}}}
ight]$

Open Calculator

 $oxed{12.56637} = rac{2 \cdot \pi \cdot 43 ext{m/s}}{21.5 ext{m/s}}$

11) Lift Force for Body moving in Fluid

 $ag{(F_L')} = rac{C_L \cdot A_p \cdot M_w \cdot \left(v^2
ight)}{V_w \cdot 2}$

Open Calculator

ex $1098.693 \mathrm{N} = rac{0.94 \cdot 1.88 \mathrm{m}^2 \cdot 3.4 \mathrm{kg} \cdot \left(\left(32 \mathrm{m/s} \right)^2 \right)}{2.8 \mathrm{m}^3 \cdot 2}$

12) Lift Force for body moving in Fluid of Certain Density

 $\mathbf{F}_{\mathrm{L}} = \mathrm{C}_{\mathrm{L}} \cdot \mathrm{A}_{\mathrm{p}} \cdot \mathbf{
ho} \cdot rac{\mathrm{v}^2}{2}$

Open Calculator

 $ext{ex} 1094.816 ext{N} = 0.94 \cdot 1.88 ext{m}^2 \cdot 1.21 ext{kg/m}^3 \cdot rac{(32 ext{m/s})^2}{2}$

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13) Lift Force on Cylinder for Circulation 🖸

fx $F_{L} = ho \cdot I \cdot \Gamma_{c} \cdot V_{\infty}$

Open Calculator 🚰

 $ext{ex} \ 53733.98 ext{N} = 1.21 ext{kg/m}^3 \cdot 8.5 ext{m} \cdot 243 ext{m}^2/ ext{s} \cdot 21.5 ext{m/s}$

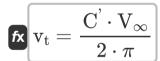
14) Radius of Cylinder for Lift Coefficient in Rotating Cylinder with Circulation

$$m R = rac{\Gamma_c}{C^{'} \cdot V_{\infty}}$$

Open Calculator 🗗

 $oxed{ex} 0.900584 \mathrm{m} = rac{243 \mathrm{m}^2/\mathrm{s}}{12.55 \cdot 21.5 \mathrm{m/s}}$

15) Tangential Velocity of Cylinder with Lift Coefficient



Open Calculator 🗗

ex $42.94398 \mathrm{m/s} = \frac{12.55 \cdot 21.5 \mathrm{m/s}}{2 \cdot \pi}$

16) Velocity of Airfoil for Circulation developed on Airfoil

$$\mathbf{E} = \frac{\Gamma}{\pi \cdot \mathbf{C} \cdot \sin(\alpha)}$$

Open Calculator 🖸

 $ext{ex} 81.08576 ext{m/s} = rac{62 ext{m}^2/ ext{s}}{\pi \cdot 2.15 ext{m} \cdot ext{sin}(6.5\degree)}$





Variables Used

- A_p Projected Area of Body (Square Meter)
- C Chord Length of Airfoil (Meter)
- Clairfoil Lift Coefficient for Airfoil
- C_I Lift Coefficient for Body in Fluid
- C Lift Coefficient for Rotating Cylinder
- F_I Lift Force on Rotating Cylinder (Newton)
- F_I Lift Force on Body in Fluid (Newton)
- Length of Cylinder in Fluid Flow (Meter)
- M_w Mass of Flowing Fluid (Kilogram)
- R Radius of Rotating Cylinder (Meter)
- **U** Velocity of Airfoil (Meter per Second)
- V Velocity of Body or Fluid (Meter per Second)
- V_∞ Freestream Velocity of Fluid (Meter per Second)
- V_t Tangential Velocity of Cylinder in Fluid (Meter per Second)
- V_w Volume of Flowing Fluid (Cubic Meter)
- α Angle of Attack on Airfoil (Degree)
- Circulation on Airfoil (Square Meter per Second)
- T_c Circulation Around Cylinder (Square Meter per Second)
- **0** Angle at Stagnation Point (*Degree*)
- ρ Density of Fluid Circulating (Kilogram per Cubic Meter)





Constants, Functions, Measurements used

- Constant: pi, 3.14159265358979323846264338327950288
 Archimedes' constant
- Function: asin, asin(Number)

 The inverse sine function, is a trigonometric function that takes a ratio of two sides of a right triangle and outputs the angle opposite the side with the given ratio.
- Function: sin, sin(Angle)
 Sine is a trigonometric function that describes the ratio of the length of the opposite side of a right triangle to the length of the hypotenuse.
- Measurement: Length in Meter (m)
 Length Unit Conversion
- Measurement: Weight in Kilogram (kg)
 Weight Unit Conversion
- Measurement: Volume in Cubic Meter (m³)
 Volume Unit Conversion
- Measurement: Area in Square Meter (m²)
 Area Unit Conversion
- Measurement: Speed in Meter per Second (m/s)
 Speed Unit Conversion
- Measurement: Force in Newton (N)
 Force Unit Conversion
- Measurement: Angle in Degree (°)

 Angle Unit Conversion
- Measurement: Density in Kilogram per Cubic Meter (kg/m³)
 Density Unit Conversion





• Measurement: Momentum Diffusivity in Square Meter per Second (m²/s)

Momentum Diffusivity Unit Conversion





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 Lift and Circulation Formulas



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